Biosignature formation by Cyanobacteria and *Chloroflexus* in the shallow deposits of a high iron thermal spring

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A unique high iron thermal spring in Yellowstone National Park is mineralizing four distinct photosynthetic microbial mat communities. *Synechococcus*/*Chloroflexus* and *Pseudanabaena* mats are found over 50-54ºC, while narrow *Oscillatoria* and *Oscillatoria princeps* mats are found over 36-45°C. We are characterizing biosignature formation and preservation in the mats and in the shallow (<2 cm) iron deposits underneath the mats. These biosignatures can be used to assess the biological contribution to ancient iron deposits on Earth (e.g., Precambrian Banded Iron Formations) and, potentially, to those found on Mars.

Optical, scanning, and transmission electron microscopy (SEM and TEM), energy dispersive spectrometry (EDS), powder X-ray diffraction (XRD) and gas chromatography-mass spectroscopy (GC-MS) were used to characterize the microfossils, biofabrics, and lipid biomarkers of the microbial mats at Chocolate Pots hot springs.

Microfossils formed by encrustation with 2-line ferrihydrite were abundant in the lower layers of the mats. Photosynthetic membranes were preserved in heavily encrusted and degraded cells, allowing positive identification of the cyanobacteria. The abundance of *n*-$C_{18:1\_9}$ and *n*-$C_{18:2}$ fatty acid methyl esters, 7,11-dimethyl-C_{16} hydrocarbons, and 2methyl-bacteriohopanepolyol indicate that cyanobacteria dominate the mats. Wax esters (*n,n*-C_{30} to *n,n*-C_{37}), characteristic of *Chloroflexus*, were also abundant. These biomarkers persisted in the iron oxide sediments underneath the mats.

This sub-aerial thermal spring provides a site to understand the formation of biosignatures in a modern cyanobacteria/*Chloroflexus* mat community and to follow their burial and earliest stages of diagenesis in an iron deposit. This will provide a means to link the source organisms to geologically significant biosignatures.